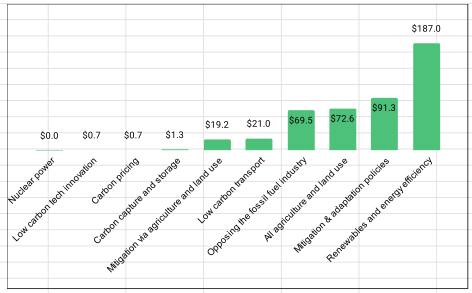
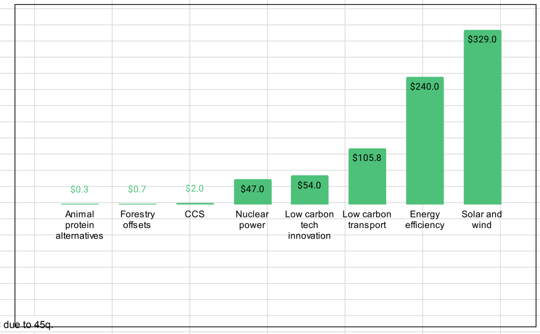
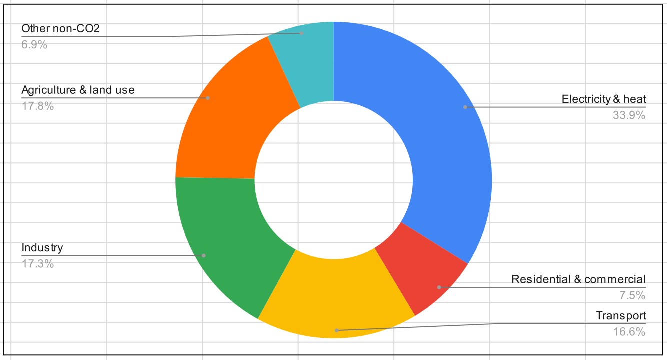
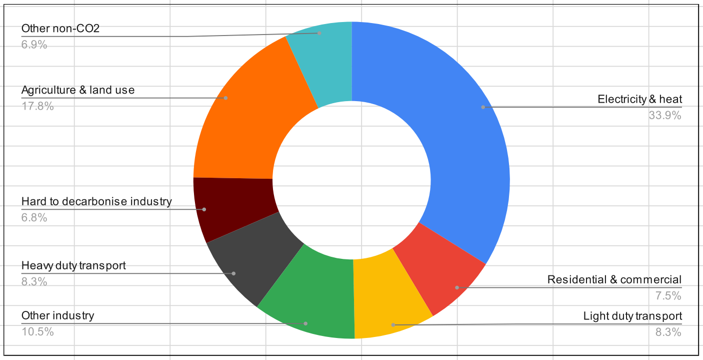
Spending from major US philanthropists (2011-15)	Millions		
Nuclear power	$0.0	Nisbet 2018: p11	
Low carbon tech innovation	$0.7	Nisbet 2018: p14	
Carbon pricing	$0.7	Nisbet 2018: p8	
Carbon capture and storage	$1.3	Nisbet 2018: p11	
Mitigation via agriculture and land use	$19.2	Nisbet 2018: Table S3	
Low carbon transport	$21.0	Nisbet 2018: p14	
Opposing the fossil fuel industry	$69.5	Nisbet 2018: p12	
All agriculture and land use	$72.6	Nisbet 2018: p14	
Mitigation & adaptation policies	$91.3	Nisbet 2018: p14	
Renewables and energy efficiency	$187.0	Nisbet 2018: p14	
Private sector spending			
Carbon pricing			
Nuclear			
Low carbon energy innovation (excl transport) (2018)	$35,000,000,000	IEA, World Energy Investment: p160-161	
Animal protein alternatives	$210,000,000	Lewis Bollard, personal communication, August 4th	
Carbon capture and storage			
Low carbon transport (2016)	$13,300,000,000	UN Biennial Assessment: p6	
Forest offsets	$625,600,000	Fertile Ground: State of Forest Carbon Finance: p2	
Energy efficiency (2016)	$257,800,000,000	UN Biennial Assessment: p6	
Renewables (2016)	$269,500,000,000	UN Biennial Assessment: p6	
Public sector spending (2016)			
Carbon pricing	NA		
Nuclear			Mostly public because mostly in China
Low carbon energy innovation (IEA only)	$19,000,000,000	IEA, Energy Technology RD&D Budgets 2020	
Animal protein alternatives (selected govts)	$75,000,000	Lewis Bollard, personal communication, August 4th	
Carbon capture and storage			Too small to matter very much
Low carbon transport (2016)	$92,500,000,000	UN Biennial Assessment: p6	
Forest offsets (2016)	$36,500,000	Fertile Ground: State of Forest Carbon Finance: p2	
Energy efficiency (2016)	$32,900,000,000	UN Biennial Assessment: p6	
Renewables (2016)	$52,300,000,000	UN Biennial Assessment: p6	
Public and private spending	Billions		
Carbon pricing	NA		
Animal protein alternatives [1]	$0.3	Calc	
Forestry offsets [2]	$0.7	Fertile Ground: State of Forest Carbon Finance: p2	
CCS [3]	$2	IEA, World Energy Investment: p32	Not visible on graph for 2018. likely changed due to 45q.
Nuclear power [4]	$47	IEA, World Energy Investment: data tables	Mostly China so mostly public
Low carbon tech innovation [5]	$54	Calc	
Low carbon transport [6]	$106	Calc	
Energy efficiency [7]	$240	IEA, World Energy Investment: data tables	
Solar and wind [8]	$329	IEA, World Energy Investment: data tables	



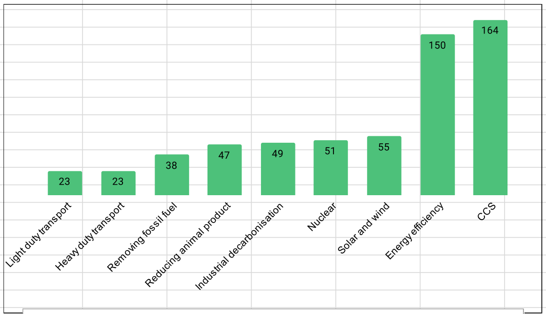


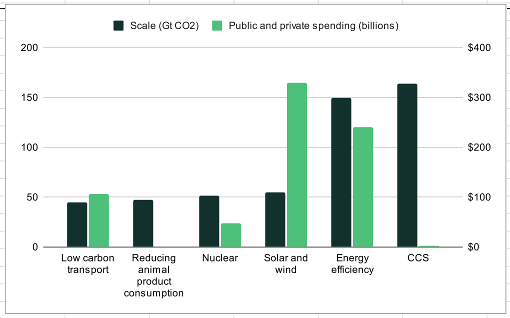
	Emissions (Gt CO2)	
Sectoral emissions		
Total	45.0	
Electricity & heat	15.3	Davis et al Figure 2
Residential & commercial	3.4	Davis et al Figure 2
Transport	7.5	Davis et al Figure 2
Industry	7.8	Davis et al Figure 2
Agriculture & land use	8.0	Agriculture & Forestry tab
Other non-CO2	3.1	Agriculture & Forestry tab
Hard to decarbonise sectors [9]		
Total	45.0	
Electricity & heat	15.3	Davis et al Figure 2
Residential & commercial	3.4	Davis et al Figure 2
Light duty transport	3.7	Davis et al Figure 2
Other industry	4.7	Davis et al Figure 2
Heavy duty transport	3.7	Davis et al Figure 2
Hard to decarbonise industry	3.1	Davis et al Figure 2
Agriculture & land use	8.0	Agriculture & Forestry tab
Other non-CO2	3.1	Agriculture & Forestry tab

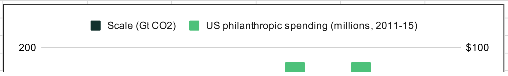




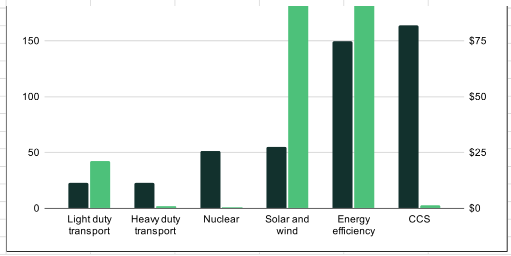
Decarbonisation contribution in 2 degree scenario		**Source**
Solar and wind		
Exajoules produced 2020	7 [10]	Our World in Data Energy
Exajoules produced 2050	50	Peters et al, supplementary info
Average exajoules produced 2020-50	28	Calc
Total exajoules produced 2020-50	850	Calc
Global carbon intensity of energy 2020 (Mt CO2 per exajoule)	65.48	Our World in Data Energy; Our World in Data, CO2 emissions
Carbon intensity of solar and wind (Mt CO2 per exajoule)	1.1	Carbon Brief
Emissions averted (Gt CO2)	55	Calc
Nuclear		
Exajoules produced 2020	10	Our World in Data Energy
Exajoules produced 2050	43	Peters et al, supplementary info
Average exajoules produced 2020-50	26	Calc
Total exajoules produced 2020-50	791	Calc
Carbon intensity of nuclear (Mt CO2 per exajoule)	0.8	Carbon Brief
Emissions averted (Gt CO2)	51	Calc
CCS		
Emissions averted 2020-50 (Gt CO2)	164 [11]	Ekins et al Table 4.1, median model
Energy efficiency		
Average emissions averted 2020-50 (Gt CO2)	5	IEA, CO2 emissions reductions in the Sustainable Development Scenario relative to the Stated Policies Scenario, 2010-2050
Total emisssions averted 2020-50	150	Calc
Industrial decarbonisation		Figures here are rough and back of the envelope - there probably is data on this in mkinsey
Average emissions on current policy (Gt CO2)	35	IEA, Sustainable Development Scenario relative to the Stated Policies Scenario, 2010-2050
% of total emissions from easy to decarbonise industry	14%	Davis et al Figure 2
Emissions averted from easy to decarbonise industry 2020-50	49	Assume that around a third of "easy to decarbonise" industrial emissions are decarbonised in 2 degree scenario
Light duty transport		
Emissons per year from light duty transport 2050 in 2 degree scenario	2	MIT Insights into Future Mobility Figure ES-1
Emissions from LDT in 2050 in reference case	3.5	MIT Insights into Future Mobility Figure ES-1
Average emissions reduced per year 2020-50	0.8	Calc
Total emissions reduced in light duty transport 2020-50	23	Calc
Heavy duty transport		
Total emissions reduced in heavy duty transport	23	We could not find data for this, so we use the assumption that heavy duty transport can make as large a contribution as light duty transport
Reducing animal product consumption		
Total emissions from animal agriculture	5.5	Agriculture and forestry tab
Projected animal product emissions in 2050 on bus as usual	10	Springmann et al, Figure 1
Average emissions bus as usual 2020 to 2050	8	Calc
Cumulative emissions to 2050 bus as usual	237	Calc
Animal product emissions 2050 on medium ambition diet change [12]	7.1	Springmann et al, Figure 1
Average emissions 2020 to 2050	6.3	Calc
Cumulative emissions to 2050 medium ambition dietary change	189.6	Calc
Emissions reductions from medium ambition dietary change	**47**	Calc
Animal product emissions 2050 on ambitious flexitarian diet change [13]	5	Springmann et al, Figure 1
Average emissions 2020 to 2050	5	Calc
Cumulative emissions to 2050 ambitious flexitarian dietary change	157	Calc
Emissions reductions from ambitious dietary change	**80**	Calc
Removing fossil fuel subsidies		
Average emissions averted 2020 to 2050 (Gt CO2)	1.25	Jewell et al, supplementary Figure 14a
Cumulative emissions averted 2020 to 2050 (Gt CO2)	38	Calc
Technology type	Scale	
Light duty transport	23	
Heavy duty transport	23	
Removing fossil fuel subsidies	38	
Reducing animal product consumption	47	
Industrial decarbonisation	49	
Nuclear	51	
Solar and wind	55	
Energy efficiency	150	
CCS	164	
Scale vs philanthropic neglectedness	Scale (Gt CO2)	US philanthropic spending (millions, 2011-15)
Light duty transport	23	$21
Heavy duty transport	23	$1
Nuclear	51	$0
Solar and wind	55	$94
Energy efficiency	150	$94
CCS	164	$1
Scale vs public and private neglectedness	Scale (Gt CO2)	Public and private spending (billions)
Low carbon transport	45	$106
Reducing animal product consumption	47	$0.3
Nuclear	51	$47
Solar and wind	55	$329
Energy efficiency	150	$240
CCS	164	$2
Philanthropic spending per Mt of CO2		
Nuclear	$0	
Industrial decarbonisation	$0	
Heavy duty transport	$0	
CCS	$8	
Energy efficiency	$623	
Light duty transport	$933	
Solar and wind	$1,708	
Public and private spending per tonne of CO2		
Forestry offsets		
CCS	$0.01	
Nuclear power	$0.92	
Meat alternatives	$0.01	
Energy efficiency	$1.60	







Decarbonisation contribution in 2 degree scenario		Source
Low carbon transport	$2.35	
Solar and wind	$6.01	
Climate science research		



		Source
Adjustments		
Methane adjustement		
Tonnes of CO2e per tonne of methane (GWP-100 no carbon cycle feedbacks) [14]	28	IPCC, WG1, p714
Tonnes of CO2e per tonne of methane (GTP-100 with carbon cycle feedbacks) [15]	11	IPCC, WG1, p714
Methane GWP-100 to GTP-100 adjustment	0.39	Calc
Agriculture and land use emissions		
Conventional estimate agricultural methane	3.9	IPCC Special Report on Land, SPM, p8.
Adjusted agriculture and land use emissions		
Forestry and other land use CO2 emissions	4.8	IPCC Special Report on Land, SPM, p8.
Adjusted agricultural methane	1.5	Calc
Agricultural nitrous oxide emissions	1.7	Olivier and Peters page 23
Adjusted total AFOLU emissions	8.0	Calc
Other non-CO2 emissions		
Other non-co2 emissions conventional estimate		
Other nitrous oxide	0.9	Olivier and Peters page 23
Other methane	5.6	Olivier and Peters page 22
Total non-CO2 emissions	7	Calc
Adjusted other non-CO2 emissions		
Other nitrous oxide	0.9	Olivier and Peters page 23
Other methane	2.2	Calc
Total non-CO2 emissions	3.1	Calc
Animal agriculture emissions		
Food methane emissions		
Food emissions from methane (Mt methane)	121.6	Calc
Flooded rice	32.6	Poore and Nemececk, Table S11
Enteric fermentation	78.3	Poore and Nemececk, Table S11
Manure management	10.7	Poore and Nemececk, Table S11
Gt of CO2e from food methane on GWP-100	3.4	Calc
Flooded rice	0.9	Calc
Enteric fermentation	2.2	Calc
Manure management	0.3	Calc
Adjusted food emisions from methane (Gt of CO2e GTP-100)	1.3	Calc
Flooded rice	0.4	Calc
Enteric fermentation	0.9	Calc
Manure management	0.1	Calc
Difference for fermentation and manure	1.5	Calc
Conventional estimate food emissions (Gt CO2e, 2014)		
Total emissions	52.3	Poore and Nemececk, Table S17
Land use change (food only)	2.4	Poore and Nemececk, Table S17
For food	0.8	Poore and Nemececk, Table S17
For feed	1.6	Poore and Nemececk, Table S17
Savannah burning	0.3	Poore and Nemececk, Table S17
Cultivated organic soils	0.6	Poore and Nemececk, Table S17
For food	0.3	Poore and Nemececk, Table S17
For feed	0.3	Poore and Nemececk, Table S17
Crop production	3.7	Poore and Nemececk, Table S17
For food	2.9	Poore and Nemececk, Table S17
For feed	0.8	Poore and Nemececk, Table S17
Livestock/aquaculture	4.1	Poore and Nemececk, Table S17
Capture fisheries	0.2	Poore and Nemececk, Table S17
Supply chain	2.4	Poore and Nemececk, Table S17
Emissions from food sector per year	13.7	Poore and Nemececk, Table S17
Emissions from animal agriclture per year	7.0	Calc
Emissions from animal agriculture with methane adjustment	**5.5**	Calc
Of which land use	29%	Calc
Of which cultivated organic soils	5%	Calc
Of which crop production	15%	Calc
Of which livestock/aquaculture	48%	Calc
Of which capture fisheries	3%	Calc
Proportion of methane emissions from animal agriculture	30%	Olivier and Peters page 22

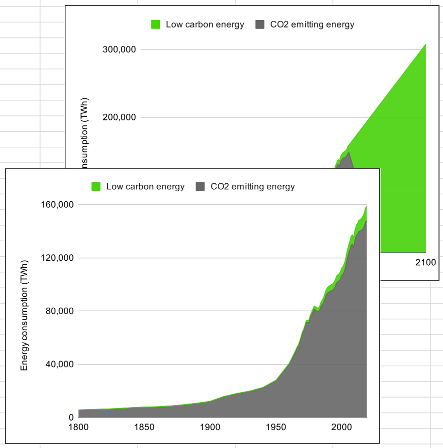
		Source
Proportion of N20 emissions from animal agriculture	56%	Olivier and Peters page 23

Current **overall** pledge (in Bn)	$10.32
Annual target (in Bn)	$100.00

		Source
Open Philanthropy long-termist money (billions) [16]	$7.0	Open philanthropy project; Dustin Moskovitz net worth
Max fraction that could be moved to climate change due to climate science research	10%	Subjective assumption
Max affectable money (billions)	$0.7	Calc
Years over which money spent down	40	Subjective assumption - this is assuming Good Ventures and Ben Delo each give all of their pledged money away until they die in roughly 40 years
Max affectable money per year (millions)	$17.5	Calc
Prior probabiltiy that research shows that climate change should be prioritised by long-termists	25%	Subjective assumption
Expected benefits of climate science research (millions)	$4.4	

Year [17]	CO2 emitting energy	Low carbon energy	Energy demand	Traditional biomass	Coal	Oil	Gas	Hydropower	Nuclear	Solar	Other renewables	Wind	Modern biofuels
1800	5,653	0		5556	97	0	0	0	0	0	0	0	0
1810	5,961	0		5833	128	0	0	0	0	0	0	0	0
1820	6,264	0		6111	153	0	0	0	0	0	0	0	0
1830	6,653	0		6389	264	0	0	0	0	0	0	0	0
1840	7,300	0		6944	356	0	0	0	0	0	0	0	0
1850	7,791	0		7222	569	0	0	0	0	0	0	0	0
1860	8,005	0		6944	1061	0	0	0	0	0	0	0	0
1870	8,592	0		6944	1642	6	0	0	0	0	0	0	0
1880	9,519	0		6944	2542	33	0	0	0	0	0	0	0
1890	10,645	14		6667	3856	89	33	14	0	0	0	0	0
1900	12,084	17		6111	5728	181	64	17	0	0	0	0	0
1910	15,584	33		6389	8656	397	142	33	0	0	0	0	0
1920	17,899	64		6944	9833	889	233	64	0	0	0	0	0
1930	19,706	131		7222	10125	1756	603	131	0	0	0	0	0
1940	22,336	192		7222	11586	2653	875	192	0	0	0	0	0
1950	27,639	333		7500	12603	5444	2092	333	0	0	0	0	0
1960	39,900	689		8889	15442	11097	4472	689	0	0	0	0	0
1965	49,714	967		9162	16140	18109	6303	923	26	0	18	0	0
1966	51,907	1,038		9218	16324	19496	6869	984	34	0	20	0	0
1967	53,601	1,067		9274	16061	20891	7375	1006	41	0	20	0	0
1968	56,351	1,133		9331	16301	22675	8044	1059	52	0	22	0	0
1969	59,596	1,207		9387	16799	24577	8833	1122	62	0	23	0	0
1970	62,825	1,280		9444	17059	26708	9614	1175	79	0	26	0	0
1971	64,962	1,365		9499	16966	28205	10292	1227	110	0	28	0	0
1972	67,946	1,467		9553	17154	30378	10861	1285	152	0	30	0	0
1973	71,400	1,539		9608	17668	32746	11378	1303	204	0	32	0	0
1974	71,273	1,732		9663	17682	32272	11656	1431	267	0	34	0	0
1975	71,352	1,853		9718	18025	31948	11661	1449	370	0	34	0	0
1976	74,848	1,914		9774	18688	34030	12356	1443	433	0	38	0	0
1977	77,047	2,072		9830	19241	35215	12761	1492	539	0	41	0	0
1978	79,064	2,283		9886	19458	36426	13294	1614	626	0	43	0	0
1979	81,450	2,392		9943	20364	37024	14119	1695	651	0	46	0	0
1980	80,674	2,493		10000	20858	35577	14239	1732	712	0	49	0	0
1981	79,946	2,663		10106	21150	34296	14394	1769	841	0	53	0	0
1982	79,264	2,774		10213	21384	33198	14469	1801	912	0	61	0	0
1983	80,038	2,980		10321	22045	32969	14703	1878	1034	0	68	0	0
1984	83,072	3,272		10430	23000	33739	15903	1941	1255	0	76	0	0
1985	84,577	3,547		10541	23986	33789	16261	1980	1489	0	78	0	0
1986	86,131	3,688		10653	24256	34803	16419	2007	1595	0	86	0	0
1987	88,755	3,861		10765	25210	35499	17281	2034	1735	0	92	0	0
1988	91,636	4,084		10879	25965	36703	18089	2099	1891	0	94	0	0
1989	93,377	4,140		10995	26213	37300	18869	2088	1945	0	104	3	0
1990	94,180	4,371		11111	25895	37691	19483	2159	2000	0	117	4	91
1991	94,552	4,534		11243	25643	37691	19975	2209	2096	1	122	4	102
1992	95,337	4,555		11376	25550	38344	20067	2209	2112	0	131	5	98
1993	95,554	4,768		11511	25675	38099	20269	2341	2185	1	135	6	100
1994	96,750	4,842		11647	25774	38935	20394	2357	2226	1	140	7	111
1995	98,292	5,078		11785	25954	39445	21108	2486	2322	1	146	8	115
1996	101,041	5,203		11925	26572	40380	22164	2520	2407	1	151	9	115
1997	102,039	5,262		12066	26527	41413	22033	2566	2390	1	161	12	132
1998	102,632	5,330		12209	26360	41624	22439	2587	2431	1	169	16	126
1999	104,382	5,451		12414	26522	42371	23075	2606	2524	1	177	21	122
2000	106,814	5,567		12500	27417	42897	24000	2652	2581	1	186	31	116
2001	107,962	5,596		12500	27853	43278	24331	2584	2654	1	192	38	127
2002	110,107	5,737		12470	28945	43639	25053	2632	2696	2	206	52	149
2003	114,189	5,738		12329	31497	44610	25753	2628	2642	2	218	63	185
2004	118,816	6,115		12160	33664	46256	26736	2821	2762	3	235	85	209
2005	122,535	6,294		12076	36171	46824	27464	2916	2769	4	255	104	246
2006	125,606	6,555		11993	38071	47367	28175	3028	2803	6	272	133	313
2007	129,418	6,723		11911	40224	47958	29325	3079	2746	8	295	171	424
2008	130,190	7,119		11829	40770	47566	30025	3257	2738	13	316	221	574
2009	127,961	7,224		11747	40149	46654	29411	3252	2699	21	340	276	636
2010	133,357	7,700		11667	41997	48087	31606	3436	2769	34	380	347	734
2011	136,493	7,834		11553	44018	48550	32372	3501	2653	65	399	441	775
2012	138,002	7,973		11441	44185	49157	33219	3650	2471	101	431	531	789
2013	139,779	8,403		11330	44993	49689	33767	3814	2493	139	464	636	857
2014	140,182	8,773		11220	44954	50014	33994	3894	2541	198	501	706	933
2015	140,628	9,025		11111	43844	50892	34781	3885	2576	257	538	832	937
2016	141,816	9,438		11111	43196	51920	35589	4013	2615	328	548	964	970
2017	143,625	9,888		11111	43360	52568	36586	4066	2639	447	583	1141	1012
2018	146,918	10,448		11111	44109	53181	38517	4171	2700	583	615	1270	1109
2019	147,872	10,967	158839	11111	43849	53620	39292	4222	2796	724	652	1430	1143
2020	143,102	17,579	160680										
2021	138,332	24,190	162522										
2022	133,562	30,802	164363										
2023	128,792	37,413	166205										
2024	124,022	44,025	168046										
2025	119,252	50,636	169888										
2026	114,482	57,248	171729										
2027	109,711	63,859	173571										
2028	104,941	70,471	175412										
2029	100,171	77,083	177254										
2030	95,401	83,694	179095										
2031	90,631	90,306	180937										
2032	85,861	96,917	182778										
2033	81,091	103,529	184620										
2034	76,321	110,140	186461										
2035	71,551	116,752	188303										
2036	66,781	123,363	190144										
2037	62,011	129,975	191986										
2038	57,241	136,587	193827										
2039	52,471	143,198	195669										
2040	47,701	149,810	197510										
2041	42,931	156,421	199352										
2042	38,161	163,033	201193										
2043	33,390	169,644	203035										
2044	28,620	176,256	204876										
2045	23,850	182,867	206718										
2046	19,080	189,479	208559										
2047	14,310	196,091	210401										
2048	9,540	202,702	212242										
2049	4,770	209,314	214084										
2050	0	215,925	215925										
2051	0	217,767	217767										
2052	0	219,608	219608										
2053	0	221,450	221450										
2054	0	223,291	223291										
2055	0	225,133	225133										
2056	0	226,974	226974										
2057	0	228,816	228816										
2058	0	230,657	230657										
2059	0	232,499	232499										
2060	0	234,340	234340										
2061	0	236,182	236182										
2062	0	238,023	238023										

Year [17]	CO2 emitting energy	Low carbon energy	Energy demand	Traditional biomass	Coal	Oil	Gas	Hydropower	Nuclear	Solar	Other renewables	Wind	Modern biofuels
2063	0	239,865	239865										
2064	0	241,706	241706										
2065	0	243,548	243548										
2066	0	245,389	245389										
2067	0	247,231	247231										
2068	0	249,072	249072										
2069	0	250,914	250914										
2070	0	252,755	252755										
2071	0	254,597	254597										
2072	0	256,438	256438										
2073	0	258,280	258280										
2074	0	260,121	260121										
2075	0	261,963	261963										
2076	0	263,804	263804										
2077	0	265,646	265646										
2078	0	267,487	267487										
2079	0	269,329	269329										
2080	0	271,170	271170										
2081	0	273,012	273012										
2082	0	274,853	274853										
2083	0	276,695	276695										
2084	0	278,536	278536										
2085	0	280,378	280378										
2086	0	282,219	282219										
2087	0	284,061	284061										
2088	0	285,902	285902										
2089	0	287,744	287744										
2090	0	289,585	289585										
2091	0	291,426	291426										
2092	0	293,268	293268										
2093	0	295,109	295109										
2094	0	296,951	296951										
2095	0	298,792	298792										
2096	0	300,634	300634										
2097	0	302,475	302475										
2098	0	304,317	304317										
2099	0	306,158	306158										
2100	0	308,000	308000										
	-147,872	297,033	149161										
	-4770.064516	3667.074074	1841.493827										



$ per tonne with REDD+	$20	Sohngen and Roopsind (2019)
Permanence		
Fraction of Brazilian results receiving payment per year (2006-17)	4%	REDD+ Info Hub
Risk of reversal conditional on future non-payment per decade	20%	Subjective input. As discussed in the main report, there is evidence from Brazil and Guyana that deforestation has risen above trend after continued REDD+ payments were not forthcoming
Risk of reversal per decade	19%	Calc. This assumes that non-payment risk follows trends in Brazil
Risk of reversal 2020 to 2050	47%	
Probability still standing by 2050 due to initial REDD+ payment	53%	
Adjusted cost per tonne	$37	
Cost premium	$17	
Reference Level gaming		
Risk that current REDD+ credit is from a gamed reference level, voiding additionality	50%	In Hargita et al, 4 of the 6 countries studied showed evidence of gamed reference levels to maximise payments, rather than to ensure genuinely additional emissions reductions.
Adjusted cost per tonne	$40	
Cost premium	$20	
Monitoring reporting and verification		
Risk that MRV does not track change in forest cover	30%	In Nomura et al, 3 of the 7 countries studied show large differences between countries' estimates and biophysical measures of forest area change
Adjusted cost per tonne	$29	
Cost premium	$9	
Cost premium	$46	
Adjusted cost	$66	

[1] 2019

[2] 2016

[3] 2018

[4] 2018

[5] 2019

[6] 2016

[7] 2018

[8] 2018

[9] Note that there the different sources here provide different estimates of sectoral emissions.

[10] 0.0036 exajoules in a terawatt hour

[11] This is not zero, but data is not available from Our World in Data, and is close enough to zero for this to be accurate

[12] This involves maximum 3 portions of red meat per week, and calories restricted to 2100-2200kcal, as per dietary guidelines

[13] Springmann et al define this as one serving of red meat per week, half a portion of white meat per day, and one portion of diary per day (Extended data table 1)

[14] This is the commonly used metric for CO2e

[15] We prefer the GTP-100 metric to the GWP-100 metric for reasons discussed in the report

[16] Dustin Moskovitz's net worth is estimated at $14bn and Open Philanthropy plan to move 50% of money to long-termist causes

[17] Source: Our World in Data, Energy